

Disrupted Classrooms: How Global Conflicts Reshape International Education Systems and Pharmaceutical Research Mobility

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Abstract:

Global conflicts have emerged as a critical disruptor of international education systems, fundamentally altering patterns of academic mobility and collaborative research. In an increasingly interconnected academic environment, higher education institutions rely heavily on cross-border student exchange, faculty mobility, and multinational research networks. However, geopolitical instability, armed conflicts, and regional tensions have significantly interrupted these systems, creating long-term structural challenges.

This study examines the multidimensional impact of global conflicts on international education and pharmaceutical research mobility, with particular emphasis on disruptions in student migration, institutional functionality, and collaborative scientific output. Conflicts contribute to large-scale displacement of students and researchers, resulting in interrupted academic trajectories and reduced access to global education opportunities. Simultaneously, restrictive visa policies and geopolitical barriers further limit mobility, disproportionately affecting scholars from developing and conflict-affected regions.

The pharmaceutical research sector, which depends on international collaboration for drug discovery, clinical trials, and regulatory harmonization, is particularly vulnerable to such disruptions. Conflicts not only delay clinical trials and compromise data integrity but also accelerate brain drain, leading to unequal distribution of scientific expertise.

The paper also explores adaptive responses, including the rapid expansion of digital learning platforms and remote research collaboration tools, while critically evaluating their limitations in practical and laboratory-based disciplines. Furthermore, it highlights the role of policy interventions, international support mechanisms, and emerging education hubs in mitigating these challenges.

Overall, this study argues that building resilient, flexible, and inclusive global education systems is essential to sustain pharmaceutical innovation and ensure continuity in academic development amid ongoing geopolitical uncertainties.

Keywords

Global conflicts; International education systems; Academic mobility; Pharmaceutical research mobility; Geopolitical instability; Clinical trials disruption; Brain drain; Digital education; Research collaboration; Higher education policy

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1. INTRODUCTION

Over the past few decades, globalization has significantly transformed the structure and functioning of higher education systems worldwide. The expansion of international education has enabled the free flow of students, researchers, and knowledge across borders, fostering academic collaboration and innovation. This interconnected academic ecosystem has been particularly critical in research-intensive disciplines such as pharmaceutical sciences, where progress depends on multinational cooperation, shared infrastructure, and diverse clinical populations (Altbach & de Wit, 2020; Marginson, 2018). However, the increasing frequency of global conflicts has begun to disrupt these established systems, raising concerns about the sustainability of international academic mobility and research collaboration.

Global conflicts—including armed wars, regional instability, and geopolitical tensions—have far-reaching implications beyond immediate humanitarian and economic consequences. Recent reports indicate that conflict-affected regions experience severe disruptions in education systems, including institutional closures, displacement of students, and interruption of academic activities (UNESCO, 2022). These disruptions not only affect local education systems but also extend globally by weakening international academic networks and reducing cross-border engagement. As discussed in Section 2, such structural disruptions significantly limit access to international education and create inequalities in academic participation.

One of the most critical consequences of global conflicts is the displacement of students and researchers, which interrupts academic progression and reduces participation in global education systems. Displaced individuals often face challenges such as lack of documentation, financial constraints, and limited institutional support, making it difficult to continue their education (UNESCO, 2022; World Bank, 2021). At the same time, geopolitical tensions have led to increasingly restrictive immigration and visa policies, further limiting academic mobility. Studies suggest that students from conflict-affected regions encounter higher barriers in accessing international education opportunities, thereby reinforcing global inequalities (Marginson, 2018; OECD, 2020). These mobility constraints have direct implications for research collaboration, particularly in globally integrated fields such as pharmaceutical sciences, as elaborated in Section 3.

2. Conceptual Gap in the Pharmaceuticals and Education

The pharmaceutical research sector is uniquely dependent on international collaboration and mobility, making it particularly vulnerable to disruptions caused by global conflicts. Drug discovery and development require coordinated efforts across multiple countries, involving shared data, diverse patient populations, and harmonized regulatory frameworks (Thiers et al., 2008; OECD, 2020). Conflicts disrupt these processes by restricting access to research infrastructure, delaying clinical trials, and limiting the movement of skilled professionals. Furthermore, conflicts often accelerate brain drain, as researchers migrate from unstable regions to more secure environments, leading to an uneven distribution of scientific expertise. As examined in Section 3, these disruptions significantly affect research productivity and innovation in the pharmaceutical sector.

In response to these challenges, education systems and research communities have increasingly adopted digital technologies to maintain continuity. The rapid expansion of online learning platforms and virtual collaboration tools has enabled institutions to sustain academic activities during periods of instability (Dhawan, 2020). However, while digital solutions provide temporary relief, they cannot fully replace the practical and experiential components of pharmaceutical education and laboratory-based research. As critically analyzed in Section 4, these adaptive strategies offer resilience but also highlight the limitations of technology in addressing structural disruptions.

Despite the growing body of literature on conflict and education, existing research often examines the impact of global conflicts on education systems and research activities in isolation. There is a lack of integrated analysis that connects disruptions in international education with their implications for pharmaceutical research mobility. This gap limits a comprehensive understanding of how global conflicts reshape interconnected academic systems.

Therefore, this study aims to provide a holistic analysis of how global conflicts disrupt international education systems and pharmaceutical research mobility. Specifically, it seeks to examine the structural barriers to academic mobility, the impact on research collaboration and clinical trials, and the effectiveness of adaptive strategies in mitigating these challenges. By integrating these dimensions, the study contributes to a broader understanding of how global academic systems can build resilience and sustain innovation in the face of ongoing geopolitical uncertainties.

3. Impact on Pharmaceutical Research Mobility (Author-wise Cross-Referenced, High Depth)

Pharmaceutical research is inherently global in nature, relying on the seamless integration of international collaboration, researcher mobility, and access to diverse patient populations. As highlighted in Section 1, the advancement of drug discovery, clinical trials, and translational medicine depends on coordinated efforts across multiple countries and institutions. However, global conflicts have significantly disrupted these interconnected systems, creating barriers that affect research productivity, innovation, and knowledge exchange (OECD, 2020; Thiers et al., 2008).

One of the most critical impacts of global conflicts on pharmaceutical research mobility is the disruption of international collaboration. Collaborative research projects often involve multiple stakeholders, including universities, pharmaceutical companies, and regulatory agencies across different countries. Geopolitical tensions and conflicts can lead to the suspension of partnerships, restrictions on data sharing, and reduced trust between collaborating entities (OECD, 2020). As a result, ongoing research projects may be delayed or terminated, leading to a decline in scientific output and innovation. This disruption is closely linked to the fragmentation of international education systems discussed in Section 2, where weakened academic networks limit opportunities for collaborative research.

Clinical trials, which form the backbone of pharmaceutical innovation, are particularly vulnerable to disruptions caused by global conflicts. The successful execution of clinical trials requires stable environments, regulatory consistency, and access to diverse patient populations. Conflicts often lead to the suspension or termination of trials in affected regions, compromising data collection and delaying drug development timelines (Thiers et al., 2008). Furthermore, instability can affect patient recruitment, ethical oversight, and data integrity, raising concerns about the reliability of clinical outcomes. As noted in Section 2, the displacement of populations and institutional instability further exacerbate these challenges by reducing access to trial participants and research infrastructure.

Another significant consequence of global conflicts is the acceleration of brain drain within the pharmaceutical research sector. Highly skilled researchers, scientists, and healthcare professionals often migrate from conflict-affected regions to more stable countries in search of safety and better opportunities (World Bank, 2021). While this migration benefits host countries by enhancing their research capacity, it creates a significant loss of talent in the countries of origin, weakening local research ecosystems and limiting their ability to contribute to global scientific advancements. This unequal distribution of expertise reinforces existing disparities in global research capacity and innovation.

In addition to human resource challenges, global conflicts also disrupt funding mechanisms for pharmaceutical research. Governments in conflict-affected regions often reallocate financial resources toward defense and emergency response, reducing investment in research and development (OECD, 2020). International funding agencies may also withdraw or limit support due to security concerns, further constraining research activities. These financial disruptions hinder long-term research projects, delay innovation cycles, and reduce opportunities for early-career researchers. As discussed in Section 2, similar financial constraints also affect international education systems, highlighting the interconnected nature of these challenges.

Supply chain disruptions represent another critical barrier to pharmaceutical research mobility during global conflicts. The development of pharmaceuticals requires the timely availability of raw materials, laboratory equipment, and technological resources. Conflicts can interrupt global supply chains, leading to shortages of essential materials and delays in research activities. These disruptions not only affect ongoing projects but also increase the cost and complexity of conducting research, particularly in resource-limited settings.

Furthermore, regulatory and ethical challenges become more pronounced during periods of conflict. Differences in regulatory frameworks, combined with instability in governance, can delay approvals for clinical trials and research activities. Ethical concerns related to conducting research in conflict zones also emerge, particularly regarding patient

safety, informed consent, and data reliability (Thiers et al., 2008). These challenges complicate the research process and may discourage international collaboration in affected regions.

Despite these significant challenges, adaptive strategies have begun to emerge within the pharmaceutical research ecosystem. Researchers are increasingly utilizing digital platforms for data sharing, virtual collaboration, and remote monitoring of clinical trials. While these approaches provide partial solutions, they cannot fully replace the need for physical infrastructure, laboratory access, and in-person collaboration. As will be discussed in Section 4, digital transformation offers resilience but also introduces new limitations and inequalities in access to research resources.

In summary, global conflicts have a profound impact on pharmaceutical research mobility by disrupting collaboration, delaying clinical trials, accelerating brain drain, and constraining funding and resources. These challenges not only affect immediate research outcomes but also have long-term implications for global healthcare innovation. Building on this analysis, Section 4 examines the role of digital transformation and adaptive strategies in mitigating these disruptions and sustaining research continuity.

4. Adaptive Responses and Digital Transformation

In response to the disruptions caused by global conflicts in international education and pharmaceutical research mobility, institutions and researchers have increasingly turned toward digital technologies and adaptive strategies to maintain continuity. As discussed in Sections 2 and 3, the breakdown of physical mobility, institutional stability, and collaborative networks has necessitated alternative approaches that can sustain academic and research activities under conditions of geopolitical uncertainty. Among these, digital transformation has emerged as a central mechanism for resilience, although its effectiveness remains uneven across disciplines and regions.

One of the most significant adaptive responses has been the rapid expansion of online and hybrid learning models. Digital education platforms have enabled universities to continue teaching activities despite disruptions caused by conflict, displacement, and restricted mobility. Dhawan (2020) highlights that online learning played a critical role in ensuring academic continuity during crises by providing flexible and accessible learning environments. However, while these platforms address issues of access, they also expose disparities in digital infrastructure, particularly in low- and middle-income countries. As noted in Section 2, such inequalities can reinforce existing gaps in international education, limiting the effectiveness of digital solutions in achieving equitable access.

In the context of pharmaceutical research, digital transformation has facilitated remote collaboration and data sharing among researchers. Virtual communication tools, cloud-based data systems, and digital repositories have enabled continued interaction between international research teams despite travel restrictions and geopolitical barriers (OECD, 2020). These tools support ongoing research activities by allowing scientists to collaborate, analyze data, and share findings without the need for physical mobility. However, as discussed in Section 3, pharmaceutical research often requires laboratory-based experimentation and clinical validation, which cannot be fully replicated through digital means.

Another important development has been the adoption of decentralized and remote clinical trial models. Advances in digital health technologies, including telemedicine and remote monitoring systems, have allowed certain aspects of clinical trials to continue even in unstable environments. These approaches reduce the need for physical presence at trial sites and enable broader patient participation (Thiers et al., 2008). Nevertheless, concerns remain regarding data reliability, patient compliance, and regulatory acceptance of remotely collected data. These challenges highlight the limitations of digital solutions in maintaining the rigor and integrity of pharmaceutical research.

Despite the advantages of digital transformation, significant structural limitations persist. Access to reliable internet, technological infrastructure, and digital literacy varies widely across regions, particularly in conflict-affected areas. This digital divide restricts the ability of institutions and individuals to fully benefit from online education and remote research tools (World Bank, 2021). Furthermore, disciplines such as pharmaceutical sciences require hands-on training, laboratory exposure, and clinical practice, which are difficult to deliver effectively through virtual platforms. As a result, while digital strategies provide temporary continuity, they cannot fully replace traditional modes of education and research.

In addition to technological adaptations, institutional and policy-level strategies have also emerged as critical responses to global conflicts. International organizations and governments have introduced support mechanisms such as emergency scholarships, relocation programs, and flexible academic policies to assist displaced students and researchers (European Commission, 2022). Universities have also developed regional partnerships to reduce dependence on global mobility and ensure continuity of academic activities. These strategies complement digital solutions by addressing structural barriers and promoting resilience within education and research systems.

However, the effectiveness of these adaptive responses depends on their ability to integrate digital innovation with structural reforms. Relying solely on technological solutions may lead to superficial continuity without addressing underlying inequalities and systemic disruptions. A balanced approach that combines digital transformation with policy support and institutional collaboration is essential for building resilient academic systems.

In summary, digital transformation and adaptive strategies have played a crucial role in mitigating the impact of global conflicts on international education and pharmaceutical research mobility. While these approaches provide important pathways for continuity, they also reveal significant limitations related to access, quality, and practical applicability. As global conflicts continue to evolve, there is a need for more integrated and sustainable solutions that go beyond temporary adaptations. Building on this discussion, Section 5 examines the policy implications and strategic interventions required to strengthen resilience in global education and research systems.

5. Policy Implications and Institutional Strategies

The widespread disruption of international education systems and pharmaceutical research mobility caused by global conflicts necessitates comprehensive policy interventions and institutional strategies. As discussed in Sections 2, 3, and 4, these disruptions are multidimensional, affecting mobility, infrastructure, funding, and collaboration. Addressing such complex challenges requires coordinated efforts at national, regional, and global levels to ensure resilience, continuity, and equitable access to education and research opportunities.

One of the most critical policy responses involves the development of targeted support mechanisms for displaced students and researchers. Global conflicts have resulted in a significant increase in academic displacement, with many individuals unable to continue their education or research due to financial, legal, and logistical barriers (UNESCO, 2022). In response, governments and international organizations have introduced emergency scholarships, flexible visa policies, and relocation programs aimed at integrating displaced individuals into stable academic systems (European Commission, 2022). These initiatives not only support individual academic continuity but also help preserve global intellectual capital, which is essential for sustaining research ecosystems.

In addition to individual-level support, strengthening institutional resilience has emerged as a key priority. Universities and research institutions must develop contingency frameworks that allow them to continue functioning during periods of instability. This includes diversifying funding sources, establishing backup research infrastructure, and adopting flexible academic policies such as credit transfer systems and hybrid learning models. Altbach and de Wit (2020) emphasize that institutions capable of adapting to changing geopolitical conditions are better positioned to maintain academic continuity and global engagement. As highlighted in Section 4, integrating digital tools with institutional planning can further enhance resilience.

Another important strategy involves promoting regional collaboration as an alternative to heavily globalized academic networks. Global conflicts often disrupt long-distance collaborations due to political tensions and travel restrictions. In such scenarios, regional partnerships can provide more stable and accessible platforms for academic exchange and research collaboration (OECD, 2020). By strengthening regional education hubs and research networks, countries can reduce their dependence on distant global systems while maintaining continuity in knowledge exchange. This approach is particularly relevant for emerging economies, as further discussed in Section 6.

Flexible and sustainable funding models are also essential for mitigating the impact of global conflicts on education and research. As noted in Sections 2 and 3, conflicts often lead to the reallocation of resources toward defense and emergency response, resulting in reduced investment in education and research. To address this challenge, governments and funding agencies must develop adaptive funding mechanisms that ensure continuity of academic and research activities even during periods of instability (World Bank, 2021). Public-private partnerships, international

funding collaborations, and decentralized grant systems can play a crucial role in sustaining long-term research projects, particularly in the pharmaceutical sector.

Policy harmonization and regulatory flexibility are equally important in maintaining pharmaceutical research mobility. Differences in regulatory frameworks across countries can create barriers to clinical trials and collaborative research, especially during conflicts. Streamlining regulatory processes and promoting international standards can facilitate smoother research operations and reduce delays in drug development (Thiers et al., 2008). Additionally, ethical guidelines must be strengthened to ensure that research conducted in conflict-affected regions adheres to global standards of safety and integrity.

Furthermore, addressing the issue of brain drain requires strategic interventions aimed at retaining and redistributing talent. While migration of skilled researchers is often inevitable during conflicts, policies that encourage knowledge exchange, return migration, and remote collaboration can help mitigate its negative effects (World Bank, 2021). Creating attractive research environments, offering competitive funding, and fostering international partnerships can enable countries to retain talent and strengthen their research capacity.

Despite the availability of these policy and institutional strategies, their effectiveness depends on coordinated implementation and long-term commitment. Fragmented or short-term approaches may provide temporary relief but fail to address underlying structural challenges. Therefore, a comprehensive and integrated policy framework is necessary to ensure that international education systems and pharmaceutical research networks remain resilient in the face of ongoing geopolitical uncertainties.

In summary, addressing the impact of global conflicts on education and research requires a combination of targeted support programs, institutional resilience, regional collaboration, flexible funding, and regulatory harmonization. These strategies not only mitigate immediate disruptions but also contribute to the development of more robust and adaptive academic systems. Building upon this policy perspective, Section 6 explores the role of emerging education hubs, particularly in developing countries such as India, in sustaining global education and research continuity.

6. Emerging Education Hubs and the Shifting Global Academic Landscape

The disruptions caused by global conflicts in traditional education hubs have led to a gradual reconfiguration of the global academic landscape, creating opportunities for emerging education hubs to play a more prominent role. As discussed in Sections 2 and 5, restrictions on mobility, institutional instability, and policy barriers in conflict-affected or geopolitically sensitive regions have reduced the accessibility of established global education centers. In this context, countries with relatively stable political environments and expanding academic infrastructure—such as India—are increasingly positioned as alternative destinations for international students and researchers (Altbach & de Wit, 2020).

India, in particular, has emerged as a significant player in global higher education due to its large network of universities, cost-effective education system, and growing emphasis on research and innovation. Government initiatives aimed at internationalization, such as promoting foreign student enrollment and strengthening research capacity, have contributed to this transition. Marginson (2018) highlights that emerging economies are becoming important contributors to global education by providing accessible alternatives to traditional Western education hubs. This shift is further accelerated by global conflicts, which redirect student mobility toward safer and more affordable regions.

In the field of pharmaceutical sciences, India holds a strategic advantage due to its well-established pharmaceutical industry and expanding research ecosystem. The country is recognized as a global leader in generic drug manufacturing and has a strong foundation in pharmaceutical education and research. As global conflicts disrupt traditional research networks, India has the potential to attract displaced researchers, international collaborations, and clinical research opportunities. This aligns with the need for diversified research locations, as discussed in Section 3, where reliance on limited geographic regions has been identified as a vulnerability in global pharmaceutical research systems.

Furthermore, the availability of diverse patient populations and relatively lower operational costs makes emerging hubs like India attractive for conducting clinical trials. Thiers et al. (2008) emphasize that globalization of clinical

research has increasingly shifted toward regions that offer both diversity and cost efficiency. In the context of global conflicts, this trend may accelerate as pharmaceutical companies and research institutions seek stable and accessible environments for their studies. However, this transition also requires robust regulatory frameworks and ethical oversight to ensure the quality and integrity of research.

Despite these opportunities, several challenges must be addressed for emerging education hubs to fully realize their potential. Infrastructure limitations, disparities in research funding, and bureaucratic hurdles can hinder the effective integration of international students and researchers. The World Bank (2021) notes that while developing countries have the capacity to expand their role in global education, sustained investment in infrastructure, digital connectivity, and institutional quality is essential. Additionally, aligning academic standards with global benchmarks is necessary to ensure international recognition and competitiveness.

Another critical consideration is the need for policy readiness and institutional adaptability. As discussed in Section 5, the effectiveness of emerging hubs depends on their ability to implement flexible policies, support academic mobility, and foster international collaboration. This includes simplifying visa processes, expanding scholarship programs, and creating supportive environments for foreign researchers. Without such measures, the potential benefits of increased academic inflow may not be fully realized.

Moreover, the rise of emerging education hubs has implications for global equity in education and research. While these hubs can provide alternative opportunities for displaced students and researchers, they must also ensure inclusivity and accessibility for diverse populations. This requires balancing domestic educational priorities with internationalization efforts, ensuring that local students also benefit from expanded academic resources and global exposure.

In summary, global conflicts are accelerating the shift toward emerging education hubs, reshaping traditional patterns of international education and research mobility. Countries like India have the potential to play a pivotal role in sustaining global academic continuity, particularly in pharmaceutical research. However, realizing this potential requires strategic investments, policy reforms, and institutional strengthening. Building on these insights, the final section (Section 7) synthesizes the key findings of this study and outlines broader implications for the future of global education and pharmaceutical research systems.

7. Conclusion

Global conflicts have emerged as a significant structural force reshaping international education systems and pharmaceutical research mobility. As this study has demonstrated across Sections 2 through 6, the impact of geopolitical instability extends far beyond immediate humanitarian concerns, fundamentally altering the dynamics of academic access, collaboration, and innovation. The interconnected nature of global education and research systems, which once served as a strength of globalization, has also become a point of vulnerability under conditions of conflict and uncertainty (Altbach & de Wit, 2020).

One of the central findings of this study is that global conflicts disrupt international education systems at multiple levels, including student mobility, institutional stability, and access to resources. Displacement of students and researchers, combined with restrictive visa policies and financial constraints, has created significant barriers to academic participation (UNESCO, 2022; Marginson, 2018). As discussed in Section 2, these disruptions contribute to a fragmented global education landscape characterized by increasing inequality and reduced opportunities for cross-border engagement.

The study further highlights that pharmaceutical research mobility is particularly vulnerable to these disruptions due to its reliance on international collaboration and infrastructure. Interruptions in clinical trials, reduced research funding, and the migration of skilled professionals have collectively slowed the pace of innovation and weakened research ecosystems (OECD, 2020; Thiers et al., 2008). As explored in Section 3, these challenges not only affect current research outcomes but also have long-term implications for global healthcare development and access to new therapies.

Adaptive responses, particularly digital transformation and remote collaboration, have provided important mechanisms for maintaining continuity during periods of instability. However, as critically analyzed in Section 4,

these solutions are limited in their ability to fully replace the experiential and infrastructure-dependent aspects of education and pharmaceutical research (Dhawan, 2020). The persistence of the digital divide further complicates the effectiveness of these strategies, reinforcing existing inequalities in access and quality.

From a policy perspective, the study underscores the importance of coordinated interventions aimed at enhancing resilience in education and research systems. Support programs for displaced individuals, flexible funding mechanisms, regional collaboration, and regulatory harmonization are essential components of a comprehensive response (World Bank, 2021; European Commission, 2022). As discussed in Section 5, such strategies must be implemented in an integrated and sustained manner to address both immediate disruptions and long-term structural challenges.

The emergence of alternative education hubs, particularly in developing countries such as India, represents a significant shift in the global academic landscape. As highlighted in Section 6, these regions have the potential to absorb displaced talent, sustain research activities, and contribute to the decentralization of global education systems. However, realizing this potential requires substantial investment in infrastructure, policy reform, and quality assurance to ensure global competitiveness and inclusivity.

Overall, this study emphasizes that global conflicts are not temporary disruptions but transformative forces that are redefining the future of international education and pharmaceutical research. Building resilient, flexible, and inclusive academic systems is essential to sustaining global knowledge exchange and innovation. Future research should focus on developing conflict-resilient education models, strengthening digital and physical integration in research systems, and exploring new frameworks for equitable global collaboration.

In conclusion, while global conflicts pose significant challenges, they also present an opportunity to reimagine and restructure international education and research systems in a way that is more adaptive, decentralized, and resilient. Ensuring continuity in pharmaceutical research and education is not only an academic priority but also a global public health imperative.

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